THURSDAY, MARCH 4, 1897.

THE NEED OF ORGANISING SCIENTIFIC OPINION.

I.

"Dear Sir,—You wish to know my notions
On sartin pints thet rile the land;
There's nothin' that my natur' so shuns
Ez bein' mean or underhand;
I'm a straight-spoken kind o' creetur
Thet blurts right out wut's in his head."

"There is a point where toleration sinks into sheer baseness and poltroonery. The toleration of the worst leads us to look on what is barely better as good enough, and to worship what is only moderately good. Woe to that man, or that nation, to whom mediocrity has become an ideal!"

LOWELL: "Biglow Papers."

"When a nation is unhappy, the old Prophet was right and not wrong in saying: Ye have forgotten God, ye have quitted the ways of God, or ye would not have been unhappy. It is not according to the laws of Fact that ye have lived and guided yourselves, but according to the laws of Delusion, Imposture and wilful and unwilful *Mistake* of Fact. We must have more Wisdom to govern us, we must be governed by the wisest, we must have an Aristocracy of Talent . . . but how to get it? . . . done nevertheless, sure enough, it must be; it shall and will be."

CARLYLE: "Past and Present."

MR. WILLIAMS'S little book, "Made in Germany," has considerably "riled the land," for, as most will know, it has attracted much notice. Shortly after its appearance, Lord Rosebery took it under his immediate protection, and discoursed upon it in public in a most interesting manner; and the fashion being thus set, many other politicians directly or indirectly referred to it. The Press throughout the country has contained articles innumerable discussing more or less superficially the issues which it raises. A rival volume has been published, under the title "The German Bogey," to refute, if not its conclusions, its recommendations. Last, but not least, it has pricked even the departmental conscience; and so great did the scare become, that the President of the Board of Trade felt justified, as he has lately told us, in ordering an inquiry into the matter. If report do not belie them, Sir Courtenay Boyle and Sir Robert Giffen entered on the inquiry with the desire and with the conviction that they would be able by the elastic agency of statistics to burst the big bubble blown in public by Mr. Williams; and if this be really the case, the very guarded tone of their Report is particularly noteworthy. Whatever desire they may have had to curse, if they do not bless, they at least show no cause why fault should be found with his implied main contention—which is, not merely that we are being beaten in this or that direction by commercial rivals, but that we are fast proving ourselves incapable of understanding the altered conditions under which the world now works, and of acting in accordance with such altered conditions.

Although the attention of the British public must have been in some degree attracted by all this cackling, yet there is no reason to suppose that the effect will be otherwise than ephemeral. It is clearly impossible to properly awaken John Bull from his stupid easy state of inordinate self-complacency, and whatever uneasiness he may feel for a time, he is soon reassured by comfortable optimism such as that displayed by political speakers like Lord Herschell and Mr. Ritchie in their recent addresses on foreign competition and trade, and when told that the fiscal returns show that business is improving, and that after all we are not doing so badly.

In fact, although ill at ease, the nation is incapable of appreciating the true depth and nature of its "unhappiness." Few of those who have criticised Mr. Williams, or even of those who have applied his arguments, are capable of fully understanding their force; the condition which he diagnoses as existing throughout the country must be judged by criteria other than those which mere statistics afford, or which are patent to politicians and the present race of statesmen.

Nothing could be further from the truth than a statement such as that recently made in the *Times* that it is too often forgotten that foreign countries are simply making up leeway. German industry is developing and prospering because it is conducted by methods almost exclusively forged in Germany, and which she alone of all nations knows how to use systematically, regularly and generally; because she has learnt how to organise and to discipline and to properly officer her forces; not because she has paid attention to "technical" education—but because she alone has known how to organise a true system of education, and has introduced a valid discipline into her schools; in short, because the nation has enjoyed a *scientific* education during practically the whole of the century, and is in consequence a cultured nation.

The story told by Sir Philip Magnus and his colleagues, in their interesting and most valuable letter to the Duke of Devonshire, contains absolutely no element of novelty: we merely see from it that we have to congratulate Germany on her continued attention to the advice and guidance of that "Aristocracy of Talent" which only she, of all nations of the world, has seen fit to create, to encourage and to properly utilise.

But we are not alone in our despondency. France, equally with ourselves, is alarmed at and envious of the success of Germany; her position is singularly similar to our own, as she also suffers from the want of a true national ideal of education. That two peoples such as the French and the English should lapse into such a state of flutter, however, is more than passing strange, and betokens great uneasiness of conscience, as we cannot either of us possibly imagine that we are to be left alone to manufacture for the world, or that those whom circumstances have so long unfortunately prevented from contributing their fair share are for ever to be kept under.

The ungenerous character of our complaints against articles made in Germany ought to be more obvious to us than it clearly is at the moment; to say the least, it is disgraceful that we should use the selfish arguments we do, in order to rouse a feeling of responsibility in our country, especially as we thereby withdraw attention from the true nature of the evil. Germany has but done her duty and lived according to the laws of Fact, and guided herself thereby; whilst we have followed the laws of Delusion, Imposture, and wilful and unwilful *Mistake* of Fact—for however unpleasant Carlyle's pessimism may be, it is impossible to deny the relevance of his conclusions to the present situation.

Let us, then, awaken to a sense of our duty, and to a sense of the real source of the danger which not only menaces us, but by which we are already, in part, overcome. In the future, we have to fear not German competition but that of our own colonists beyond the seas, and perhaps that of our American cousins most of all, besides that of the cheap labour of the vast populations of climes where Europeans cannot work with advantage. It is folly to suppose that Lancashire can continue much longer to spin cotton for the world; but America, Egypt, India, Japan and, sooner or later, China also will deprive us of the trade—not Germany, for she will suffer proportionally with ourselves.

It is all very well to congratulate ourselves on a temporary improvement in our iron trade, and to argue that an increase of a few per cent. in our output is more than equal to the whole output of a country which, may be, is advancing its production at a far greater rate than we are; but it cannot be forgotten that we largely import our iron ores, that fuel is got with increasing difficulty, and that wages are likely to rise considerably. In America, on the other hand, wages are likely to fall rather than rise, and ores and fuel are to hand in inexhaustible quantities, so that it cannot be long ere American iron will successfully compete with English and foreign.[1] In a Trade Review Circular before me, I find the words:—"Tin-plates: The majority of the orders primarily came from the United States, but every day brings us further proof that the time is not far distant when this will almost disappear." We must recognise that, at no very distant date, this will have to be said of articles of far greater importance than tin-plates. It is well known that shipbuilding, long a staple industry of this country, is fast being developed, not only in Germany, but also in the United States. America is bound, in fact, to develop, and not only on account of the restless energy of her people: her Government departments have attached to them many active men engaged in initiating or conducting scientific inquiries; and when the various departments are organised *inter se*, the country will have in its service a highly-trained body of scientific experts guiding all branches of public work, and cooperating to minimise the faults of democracy. And universities are arising all over the country, in which German models are being followed, not English. It is safe to predict that, ere many years are past, the United States will suddenly burst into prominence, and probably into predominance, as a nation promoting scientific inquiries of all kinds, so surely is a foundation being laid. Mistakes will frequently be made, perhaps, but they will soon be recognised and remedied in a country instinct with advance.

It is useless to consider mere statistics and to contrast the money values of our imports and exports; we must consider rather the extent to which our established industries have developed in response to modern requirements, and the extent to which new industries have been developed. When this is done, it is difficult—nay, impossible—to resist the conclusion that we are becoming less and less capable of helping ourselves, and more and more the victims of chance. In the engineering trades, which have always necessarily been conducted on fairly scientific lines, being based on exact measurements, we can still hold up our heads—as witness the marvellous development of the cycle industry. But in most, if not all those in which chemistry indirectly or directly plays a part—and in which does it not?—we are daily getting more and more behind the times: the research spirit practically does not enter into our industries; scientific method has no real place in most of them. The few brilliant exceptions which may be quoted but serve to prove this rule. But these are points which entirely escape Board of Trade officials and politicians and the general public; only those who have to do with our manufacturers are aware how entirely conservative and unprogressive are their views and actions.

In English works, as a rule, the sole effective management rests with the capitalist and man of business. This class of man places himself entirely in the hands of his works-manager or foreman, whose doings he too often cannot in the least criticise; and, consequently, a commanding position is taken in this country by the so-called practical man—one who knows how to do one thing, perhaps, very well, but being without scientific training and theoretical knowledge cannot advance, and if things do not go on as they should, is at a loss to know what exactly is wrong. And such men, unfortunately, are doing their very utmost, even at the present day, to prevent the entry into works of those who, having been scientifically trained, are capable of investigating the processes in charge of which they are placed, as well as of devising improvements and of preventing waste.

How different is the state of affairs elsewhere. To quote evidence given before the Sub-Committee of the London Technical Education Board by Dr. Messel, a well-known English manufacturer conversant with both the foreign and our system, not only is the importance of science far more acknowledged by manufacturers abroad than it is here, but it is accorded a consulting and deliberating voice in the management of their industries; furthermore, at the head of affairs you mostly find people who, however little they may now be able to devote themselves to scientific pursuits, possess a thorough scientific education, which befits them to select such scientific assistance (in chemistry, engineering, construction, &c.) as their work may require, who are capable of appreciating it, and who remain in touch with scientific teachers' teaching and progress.

As Matthew Arnold wrote in 1874, in the preface to the second edition of his "Higher Schools and Universities in Germany": "German practice is governed by the notion that what is to be done, should be done *scientifically*, as they say; that is, according to the reason of the thing, under the direction of experts, and without suffering ignorance and prejudice to intrude."

The same writer, in the first edition of his work published in 1868, remarked:

"Our rule of thumb has cost us dear already, and is probably destined to cost us dearer still. It is only by putting an unfair and extravagant strain on the wealth and energy of the country that we have managed to hide from ourselves the inconvenience we suffer, even in the lines where we think ourselves most successful, from our want of systematic instruction and science."

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[1] The following paragraph from *The Times* of March 1, is an interesting confirmation of my arguments:—

THE AMERICAN STEEL RAIL TRADE.—With reference to the recent break up of the steel rail pool in the United States, it is said that the first cost to American makers of such rails is at present $15 per ton, but that probably the Carnegie Company's latest improvements in labour-saving machinery will enable it to produce them at something like $12 per ton. All steelworks are said to be making a great effort to conquer the European, and especially the South American markets, which latter had heretofore been almost monopolised by England. . . . With the help of these facilities Messrs. Carnegie and Rockefeller believe they will be able to control all markets, and to beat English railmakers on their own ground.

True at the time, these words are now doubly true. In the interval we have absolutely wasted the opportunity that was ours of securing the more important share of the coal-tar colour industry, which must be regarded as the most far-reaching of all the industries established in the Victorian era, as it carries in its train the production of synthetic products generally. Ours by right of first inception, ours as being by far the largest producers of the raw material—it has slipped away from us through sheer disregard of elementary first principles of defence, and insular narrowness of purview. Had we but appreciated and properly encouraged Hofmann and his school, how different the result might—nay, must—have been. Instead, however, of providing him with means adequate to his talents, we allowed him to languish for years in a poor one-storied building in Oxford-street, and only when too late began to think of treating him as he deserved. No foreign Government would have ever permitted such a man to be tempted away from its service. Although he returned to his native country only on a three years' visit, with the option of resuming his professorship here, on leaving our cold irresponsive atmosphere and finding himself in the warm glow of scientific enthusiasm of his fatherland, in presence of a Court at which science was deeply respected and at home, a nature such as his could not but feel the difference and elect to remain. Seeing and seizing his opportunity, he not only created a great school in Berlin, but also organised chemical science throughout Germany by the share he took in the establishment, in 1868, of the German Chemical Society, of which he remained the active leader until his death in 1892. Had he returned to us, *we* should have had a great chemical school, as the present Royal College of Science was built to plans drawn under his advice, and it was intended to devote the whole of the building to chemistry; but competition set in over the bones he had left, and they were divided without satisfying any one. We can never repair the evil wrought in those days. And all this was done under Government! Board of Trade statistics take no account of these little details, and the figures are in no way weighted thereby.

A grievous mistake was made also by the pioneers of the new industry—a mistake which was slavishly copied throughout the country, and continues to be down to the present time. It was not realised here, when laboratories were converted into manufactories, that manufactories must be conducted as laboratories if they were to remain virile institutions—that researches had to be carried on, both in order to improve the processes in use, and to discover new products to satisfy an ever-expanding public demand; no proper scientific staff was provided; and that English bugbear, the practical man without a vestige of theory in his composition, was allowed to become master of the field. Consequently, strangers stepped in who were more alive than ourselves to the necessity of working scientifically, and new prizes were instituted which they carried off: we being left in proud possession of a very honourable historical shield, but one which had become so battered that it retained little decorative value.

What does it matter—we can get our colours cheaply enough from abroad, say many; let the Germans cut each others throats, if they are so minded, in the competition to supply us at prices which, in very many cases, cannot be remunerative to them. And after all, it is worth but a few millions. But these good people forget that the loss of the colour industry implies inability to conduct any industry requiring the application of scientific skill, if it be one which must either develop or decay: and in these days there are few close boroughs in industry—secret processes are impossible. Moreover, where is the argument to stop? We may congratulate ourselves that although we eat mostly foreign bread and butter and cheese, we yet drink English milk; but we must not forget that in the future sterilised milk may perhaps be conveyed to us in tank vessels as petroleum is from America. In fact there will be no limit to the distance over which perishable articles of diet may be carried, unless our public analysts intervene more effectively in checking the introduction of preservatives such as boric acid and formic aldehyde into food materials—a modern fashion whereby, it can scarcely be doubted, the foundation is being laid in a most insidious manner for universal dyspepsia.

In short, the application of science to industry has brought the whole world into competition, and only those who fully understand and can apply all the rules and every detail of the game can hope to succeed in it. It remains to consider why we play the game so badly in many respects, and how we may learn to play it properly.

Henry E. Armstrong.

(*To be continued.*)

COMPRESSED AIR ILLNESS.

Compressed Air Illness; or, so-called Caisson Disease. By E. Hugh Snell, M.D., B.Sc. (Lond.). Pp. viii + 251. 6 Figs. (London: H. K. Lewis, 1896.)

DR. SNELL, the London County Council medical officer to the Blackwall Tunnel, has had ample clinical opportunity of observing the results of working for various periods of time in compressed air. The book before us must be regarded as a literary *résumé* of what is known upon this subject, to which is added Dr. Snell's own experience.

Chapter i. contains an historic account of caisson disease. The interest of this chapter is not purely medical; it will have to the general reader a distinct value as an account of the progress made in the application of compressed air for the purpose of building the foundations of bridges, and in subaqueous tunnelling. In this connection the references to the reports of the engineers, &c., are of special value. Chapters ii. and iii. relate exclusively to the Blackwall Tunnel, a short description of the engineering works being followed by clinical abstracts of fifty out of the two hundred cases of compressed air disease which came under the author's own observation. In the chapter which treats of ætiology, Dr. Snell discusses the relative potency of the